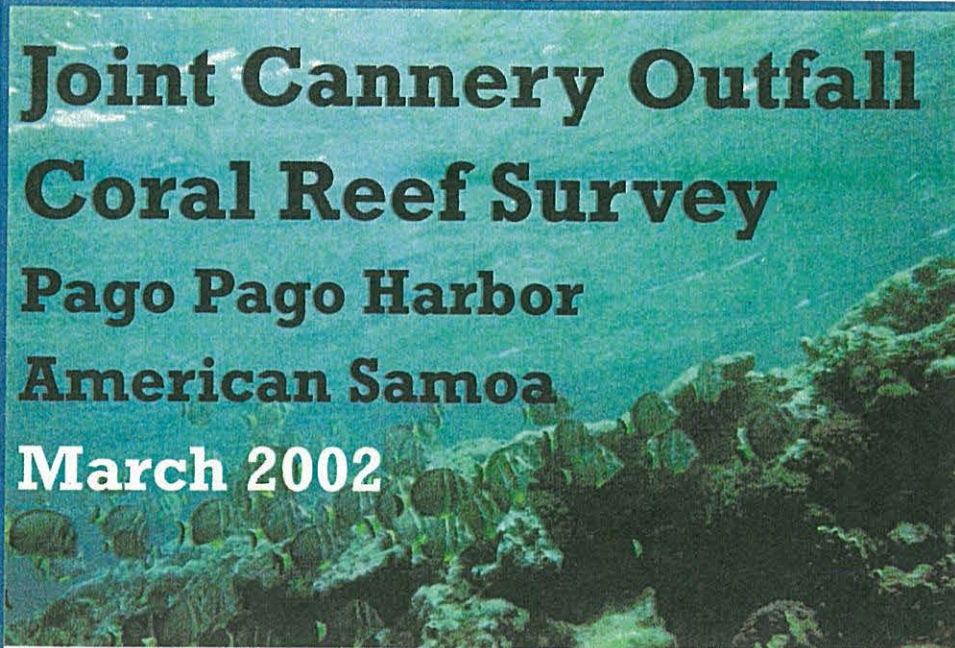


# **Joint Cannery Outfall Coral Reef Survey**

**Pago Pago Harbor**

**American Samoa**

**March 2002**



Submitted by:

**StarKist Samoa**

NPDES Permit AS0000019

**COS Samoa Packing**

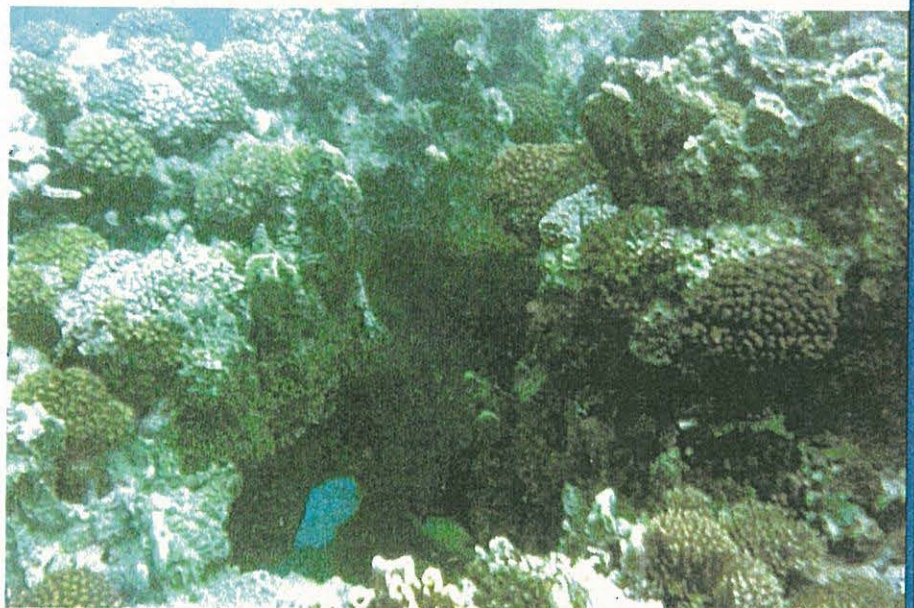
NPDES Permit AS0000027

Submitted to:

**U.S. Environmental Protection Agency**

**American Samoa Environmental Protection Agency**

**CH2M HILL  
February 2003**



**JOINT CANNERY OUTFALL  
CORAL REEF SURVEY REPORT  
MARCH 2002 SURVEY**

Submitted to:

**U.S. Environmental Protection Agency – Region 9  
and  
American Samoa Environmental Protection Agency**

Submitted by:

**StarKist Samoa, Inc.  
NPDES Permits AS0000019  
and  
COS Samoa Packing Company  
NPDES Permit AS0000027**

Prepared by:

**CH2M HILL**

28 February 2002

## ***Executive Summary***

The year 2002 coral reef survey was been conducted in Pago Pago Harbor as required by the StarKist Samoa and COS Samoa Packing NPDES permit conditions. The survey was conducted during March 2002. This survey represents the fifth coral reef survey conducted at the same sites since 1991. Four locations throughout the Harbor were surveyed.

The required series of coral reef surveys is designed to provide data needed to evaluate potential impacts of treated wastewater discharged from the Joint Cannery Outfall (JCO) on the nearby coral reef. The coral reef surveys provide information needed to evaluate and detect significant differences, if any, from an earlier study done in January of 1991. The survey sites and data collected in March 2002 were consistent with the 1991 study, and the previous results of the 1993, 1995, and 1997 surveys.

The survey was done by making video recordings of transects along constant depth contours at three depths at each site. The video recordings were then analyzed and summarized by a qualified marine ecologist with expertise in coral reef taxonomy and previous experience in American Samoa. The survey data are presented in terms of estimated hard coral coverage and the number of hard coral species identified for each transect. The surveys and the analysis of the video records were done by the same staff that conducted all of the previous surveys.

Prior to February 1992 the wastewater discharge from the canneries were through two short outfalls located in the inner Harbor. The discharge point for the canneries was relocated to the outer Harbor using the JCO. In addition, the canneries instituted high strength waste segregation in August of 1990, using an EPA approved ocean disposal site for the high strength wastes. When compared with previous surveys, the survey data for the sites studied in 2002 indicates a general improvement at three of the four sites. The fourth site shows no signs of degradation but appears to be influenced by sediment loads from a nearby stream. The site closest to the JCO discharge shows no evidence of wastewater impacts or settleable solids. A potential improvement in coral growth has been observed at this station. Since the discharge plume in the outer Harbor is trapped deeper than 60 feet most, if not all, of the time, no impact from the relocated discharge is expected in the middle or outer Harbor.

Any impacts to coral reef communities due to high strength waste segregation and outfall relocation are expected to be long term and difficult to distinguish from variability caused by other factors. The results from the previous coral reef surveys support this expectation and no definitive observable trends in reef coral communities were previously obvious based on the survey data. This was not unanticipated. However, it has been five years since the last survey in 1997 and in that time there appears to have been a quantifiable improvement in the coral reef communities at the sites surveyed in 2002.

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# 1. INTRODUCTION

This report presents the field survey results of coral reef surveys in the middle, and outer regions of Pago Pago Harbor, American Samoa. The survey was conducted March 13-14, 2002 and is the fourth in a series of required surveys and the fifth survey to be conducted at the designated stations using the same methods and scientific staff.

## 1.1 Purpose

The purpose of this report is to present the results of the most recent (March 2002) coral reef survey and compare the results to previous surveys. The survey is intended to provide information for comparison with past and future surveys. This work was conducted to comply with conditions of the United States Environmental Protection Agency (EPA) NPDES Permit No. AS0000019 for Star-Kist Samoa Inc. and NPDES Permit No. AS0000027 for COS Samoa Packing Company, Inc.

## 1.2 Background

The coral reef surveys are required under Section G of the current NPDES permits, which states the following:

*"The canneries (StarKist Samoa and COS Samoa Packing) shall cooperatively continue the coral reef survey based on the previously approved study plan for the monitoring conducted during 1993-1997 with the modifications described below. The purpose of the study is to assess the potential impacts of the discharge on the nearby coral reef. The intent of the survey is to detect significant differences, if any, from the previous surveys. VCR formatted video copies and a report of results shall be submitted to the ASEPA and USEPA with reports within 120 days of the survey.*

*The survey will be done twice during the permit period, once in year two of the permit and once in year 5 of the permit. These surveys will include a subset of the previous transect locations. Transect locations to be surveyed are MH-1, MH-4, OH-5, and OH-I (see Figure 3[Figure 2 in this report]). After reviewing the results of the first survey, ASEPA and USEPA may require different or additional transacts during the second survey and/or additional surveys."*

As indicated in the permit condition above, this survey continues the work required under the previous permit (Section I), which required:

*"Within six months of the effective date of this NPDES permit, the permittee, in cooperation with {Samoa Packing Co.; Star-Kist Samoa}, shall submit a field study design for approval by ASEPA and EPA Region 9 to assess the potential impacts of the discharge on the nearby coral reef. The study shall include coral reef transects which shall conform to locations found on Figure 4 in the USE ATTAINABILITY AND SITE-SPECIFIC CRITERIA ANALYSES; PAGO PAGO HARBOR, AMERICAN SAMOA, FINAL REPORT (CH2M HILL, March 15, 1991). The intent of this annual survey is to detect significant differences, if any, from the database information found in*



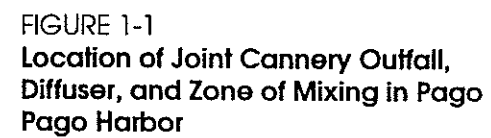
*the above-cited document. Videos shall be submitted to both the USEPA and ASEPA. Guidance for designing such surveys is provided in the Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters November 1982, EPA #430/0-82-010 (pages 70-71). In addition, the discharger should consult Ecological Impacts of Sewage Discharges on Coral Reef Communities, September 1983, EPA #430/9-83-010, for further information. The study shall be conducted within one year of the effective date of this permit and every two years thereafter."*

A Coral Reef Survey Study Plan was submitted for review and approval to the EPA and ASEPA on January 8, 1993. The study plan was designed, to the extent possible, to be consistent with a previous study done by CH2M HILL in January 1991 as referenced above in the permit condition. During the development and review of the Coral Reef Survey Study Plan, comments received from USEPA and ASEPA were reviewed and incorporated into the study plan, as necessary. The study plan, the comments on the study plan, and the response comments on the study plan were included in the study report for the February 1993 coral reef survey (CH2M HILL, 1993).

The first required study under the NPDES permit was conducted in February 1993 and reviewed by USEPA and ASEPA. One comment was received on the 1993 study, which is discussed in the description of study approach below. During the 1995 study no substantial recommended changes to the study plan were identified for future surveys, although CH2M HILL did recommend that positioning be done using an appropriate global positioning system (GPS) rather than a MiniRanger system. The last survey conducted prior to the one described in this report was in March 1997.

The current NPDES permit condition states that coral reef surveys shall be conducted at four of the same sites surveyed during the 1991 *Use Attainability Analysis* (CH2M HILL, 1991) to detect significant differences, if any, from the 1991 baseline reef survey data. These four stations are the closest stations to the present discharge of the Canneries through the Joint Cannery Outfall (JCO). The wastewater discharge locations and methods for the canneries have changed between the 1991 survey and the initiation of surveys required under the previous NPDES permit condition. This change in discharge locations has had an effect on improving receiving water conditions throughout the Harbor.

In January 1991, when the baseline reef survey study was conducted, the two canneries operated separate wastewater outfalls in the inner Harbor area of Pago Pago Harbor. Currently, Star-Kist Samoa and COS Samoa Packing operate the JCO that extends over 7,000 feet west from the canneries to a deep-water site offshore of Anasosopo Point in the outer Harbor. The outfall consists of a 16-inch HDPE pipe that terminates with a multiport diffuser at a depth of 176 feet below mean lower low water (MLLW). The outfall pipeline route and diffuser location are shown in Figure 1-1. In addition to relocating the discharge in February of 1992, the canneries began high strength waste segregation in August of 1990. Since that time cooker juice, press liquor, and DAF sludge have been disposed of at an EPA-approved ocean disposal site.



The January 1991, February 1993, March 1995, March 1997, and March 2002 surveys involved recording reef transects at multiple-depths along the reef fronts at sites located around the entire perimeter of Pago Pago Harbor. The coral reef field surveys were designed to provide comparable records of the reef conditions throughout the Harbor for use in an evaluation of reef-face habitat conditions in areas of the inner, middle, and outer Pago Pago Harbor. These surveys were designed to provide a semi-quantitative summary of reef corals and other benthic species. Reef fish identifications were incidental.

### **1.3 Approach**

The approach and methodology for the coral reef survey has been designed, to the extent feasible, to maintain consistency between the periodic studies, and to be consistent with available guidance provided in the *Design of 301(h) Monitoring Programs for Municipal Wastewater Discharges to Marine Waters* (USEPA, November, 1982). To meet the NPDES permit conditions, video transects were recorded at multiple depths at each of the four established reef transect sites around Pago Pago Harbor (Figure 1-2). Detailed methodology is presented in Sections 2 and 3 below.

The coral reef field survey described in this report was conducted to provide video transect records of the reef conditions in the areas adjacent to the canneries discharge that can be compared with the 1991, 1993, 1995, and 1997 surveys and with future surveys at the same locations. These surveys can be used to evaluate the condition of, and changes to, the reef-face habitat in areas of interest. The surveys are limited to providing semi-quantitative data on the type and percent cover of live reef corals and other benthic species. Reef fish identifications are incidental to the reef habitat evaluation.

The intent of the study is to monitor long term overall changes in the various portions of the Harbor. Since video records at the start and end of the transect locations are at fixed points, and additionally the video transect record includes scale by including the tape measure placed on the bottom, both fixed and random locations of known area can be derived from the video record if desired. However, the analysis presented in this report is intended to be a monitoring or screening level exercise to detect the onset of significant changes in the Harbor. If such changes are detected, and are considered potential adverse impacts, additional work may be required to assess the significance and causes of such changes.

The video transect records were analyzed and summarized by Mr. Troy Buckley of the University of Washington School of Fisheries. Mr. Buckley is a qualified marine ecologist with knowledge of tropical reef taxonomy and several years of site-specific experience in American Samoa. He also analyzed the 1991, 1993, 1995, and 1997 survey videos. Estimates were developed of live coral coverage and specific benthic genera identifications were provided, as feasible, from the video record. Field survey data are presented in tabular formats in the results section of this report. Supporting data are included in Appendix A. Copies of the video records are provided to ASEPA and USEPA as separate attachments to this report.



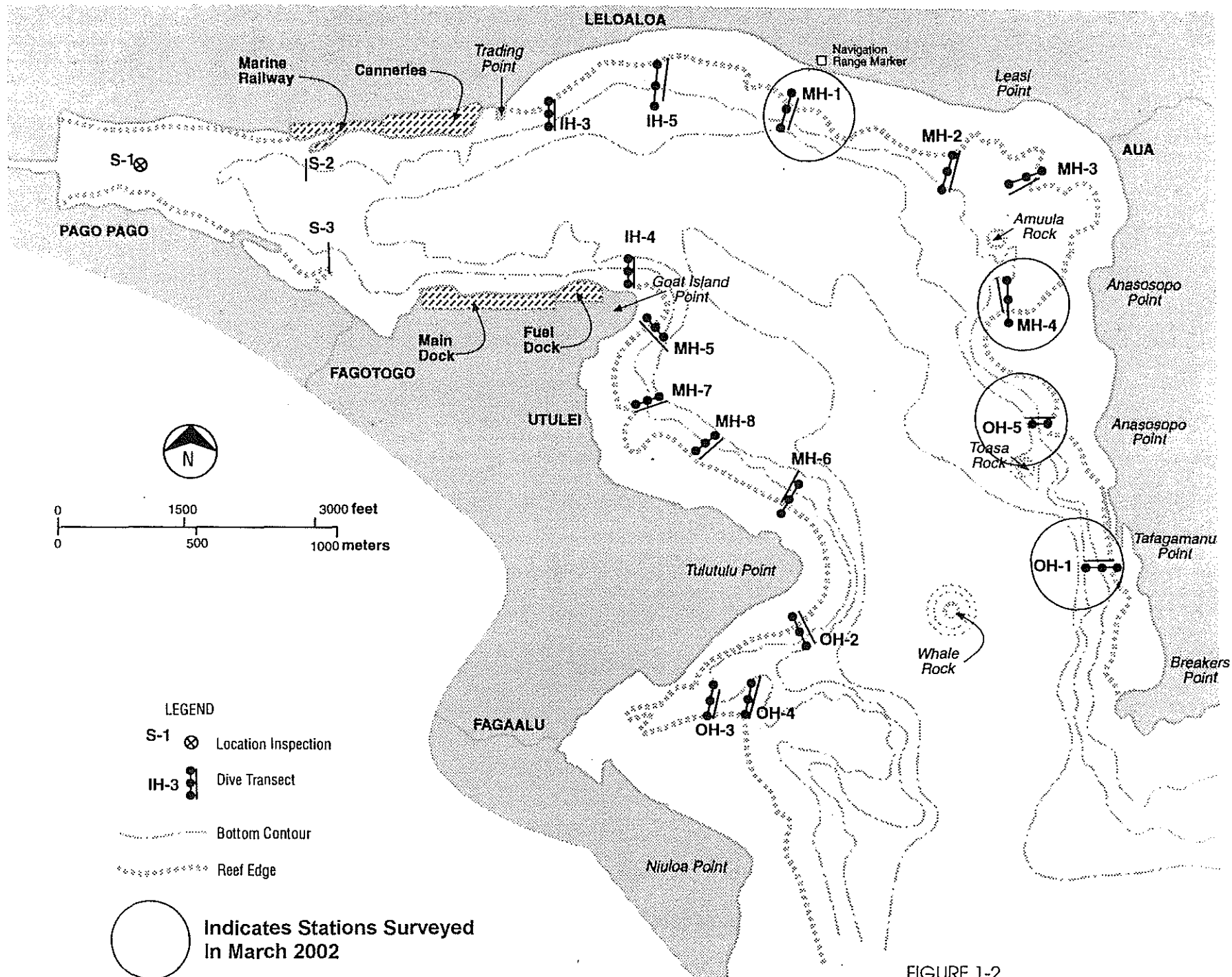


FIGURE 1-2  
Location of Coral Reef Transects  
in Pago Pago Harbor

#### 1.4 Study Site Description

The *American Samoa Coral Reef Inventory* (published by the U.S. Army Corps of Engineers in 1981), reports that the fringing coral reefs in Pago Pago Harbor have been extensively modified, primarily by the U.S. Navy and American Samoan Government. Dredging, filling, construction of rock seawalls and other structures for roadway slope stabilization, and other construction activities have resulted in physical alterations to the coral reefs. These activities began around 1900. The most dramatic changes occurred during World War II and since 1960. The Coral Reef Inventory reports that approximately 23-percent of the original reef flat area in Pago Pago Harbor has been filled.

The inner Harbor area has been the most affected by development activities. According to the Coral Reef Inventory, 95 percent of the original reef in the Inner Harbor has been converted to dry land. Some remnant reef is found in the inner Harbor area but living corals have been absent from the inner Harbor for many years. This conclusion, presented in the Coral Reef Inventory, was drawn from a 1977 study.

Substantial physical alterations to the reef in the Middle and Outer Harbor include the following as presented in the Coral Reef Inventory:

- The reef flat off the Rainmaker Hotel and Utulei Beach has been dredged to provide sandy areas for swimming and access across the reef.
- Near Aua Point, a borrow pit 18 feet deep was dredged to obtain roadbed fill material, creating a large lagoon inside the inner reef.
- The shoreline north of Tafagamanu Point was extended 300 feet onto the reef flat by filling for a sanitary landfill.
- An extensive fill area along the south Fagaalu Bay was developed for a public park from material dredged from the reef flat.
- The discharge of sediments from the streams draining into the Harbor has led to extensive siltation over large portions of the reef near the mouths of these streams (described in detail below).

The coral reefs of American Samoa have been subjected to periodic infestations or population explosions of the coral-feeding crown-of-thorns starfish (*Acanthaster planci*). The 1981 Coral Reef Inventory reported serious crown-of-thorns infestations on the reefs of Tutuila Island in the 1920s and most recently in the late 1970s and early 1980s. These periodic infestations have greatly reduced the live coral assemblages on the fringing reefs. Destruction of the live coral assemblages has been shown to vary widely, but, as described in the Coral Reef Inventory, roughly 50 to 95 percent of live coral were estimated to have been destroyed by the 1970-80 starfish infestation.

Recent dive surveys of the coral reefs in the Fagatele Bay Marine Sanctuary have shown live coral coverages of approximately 50 percent after nearly complete destruction by the

crown-of-thorns starfish. The fringing reefs of middle and outer Pago Pago Harbor were also substantially damaged by the crown-of-thorns infestation. The starfish were observed on the reefs off Aua (in middle Harbor) and of Fagaalu (outer Harbor) during 1980 when the Coral Reef Inventory was conducted. Reef recovery from these infestations is slow, and the existing live coral coverages on the fringing reefs of Tutuila Island still show large areas of dead coral.

Periodic hurricanes pass near or directly over Tutuila Island, and these storms generate large waves. Waves approaching from the south enter the outer and middle Harbor and break on fringing reef, damaging the reef habitat either directly or by disturbing sediments that are deposited on the reefs. Recent intense hurricanes, particularly Hurricane Fay, have had significant impacts on the fringing reefs in Pago Pago Harbor through wave impacts, siltation, and longline vessels grounded on the reefs. In addition, until recently, much of the roadbed abutting the reef flat was unprotected from erosion through riprap cover or other stabilization techniques, leading to extensive siltation of some areas of the reef flats. In recent years erosion protection along portions of the roadway has been substantially improved.

Potential impacts from cannery, and other point source, discharges include direct sedimentation on the reef, reduced water clarity because of sediments, and high algal productivity resulting from nutrient inputs. Impacts on coral reef communities appear to have been substantially eliminated with the implementation of high strength waste stream segregation and the relocation of the outfall diffuser to water depths of more than 170 feet in the outer Harbor.

Dye studies conducted by CH2M HILL (1992, 1993) as a condition of the NPDES permit indicate that the plume typically remains trapped in the lower part of the water column. Under certain meteorological and oceanographic conditions the plume rises further but is typically diluted to more than 2000:1 at the edge of the permitted mixing zone and does not impact the nearby coral reefs.

Harbor water quality monitoring conducted in March 1995, March 1996, November 1996, March 1997, and more recently in 2001 and 2002, as a condition of the NPDES permit, indicates that nutrient levels have fallen below the American Samoa water quality standards (ASWQS) and phytoplankton levels have similarly fallen (CH2M HILL, 1995, 1997a, 1997b, 1997c, 2002a, 2002b, 2003a, 2003b). The same studies have indicated that light penetration also meets the ASWQS.

## 2. FIELD SURVEY METHODS

This section describes the methods and equipment used for the coral reef surveys, including horizontal positioning at each reef site, sampling methods, and QA/QC procedures. The same divers that conducted the previous surveys did the 2002 survey.

### 2.1 Field Equipment

Field equipment requirements for the reef surveys are listed in Table 2-1. A small work vessel was used for the surveys. A three-person staff was aboard to conduct the reef survey transects. Two divers conducted the surveys, with a third person assigned as a boat handler and support.

Table 2-1 Field Equipment for Coral Reef Surveys		
Equipment Item	Purpose	Number of Units
Work Vessel	Field Sampling Platform	1
SCUBA diving equipment and tanks	Underwater surveys	5
Dive Computer	Continuous dive logging for each diver's repetitive dives and surface intervals (safety equipment)	2
Sony 8mm Video camera w/ underwater housing and lights	Underwater videotaping of reef transects	2
Sony 8mm Videotape player	Viewing and verification of videotape records	1
100 feet fiberglass tape measure	Provide reference line for video transects	1
Transect Stakes	Re-establish start and end point for any missing stakes	10
Depth Gage	Verify transect depths	2
GPS System	Global Positioning System	1

### 2.2 Survey Sites and Field Positioning

Four reef sites were surveyed in March 2002 (Figure 1-2). Multiple transects were conducted at three depths at each of these sites. The four reef survey sites were located based on the descriptions in the 1991 Use Attainability Analysis reef survey logbook and photographs of the reef and shoreline at each site. The horizontal position of each site was established in February 1993 using a Motorola Mini-Ranger III electronic positioning system. The Mini-Ranger III provides positioning range accuracy of approximately  $\pm 2$  meters. The previously established Mini-Ranger locations of each site and the site descriptions are given in Table 2-2.

<p align="center"><b>Table 2-2</b>  <b>Middle Harbor Transect Locations for Coral Reef Survey Pago Pago Harbor</b>  Established During February 1993 Survey  <i>{Indicated Transects Re-established During March 1995 Survey}</i></p>			
Station	Sampling Location and Depth (feet)	Navigation Coordinates for MiniRanger System (a,b)	
		Code 1	Code 4
MH-1	Middle Harbor, located off Harbor front range marker (Code 1), Transects at 25, 40, and 60 feet	216 (S)	1198 (S)
MH-4	Middle Harbor, located on north face of reef and west of Aua Point, Transects at 25, 40, and 60 feet	1082 (S)	1649 (S)
OH-1	Outer Harbor, located on west face of reef off Tafagamanu Point, Transects at 25, 40, and 60 feet	2033 (S) <i>{1954 (S)}</i>	2166 (S) <i>{2154 (S)}</i>
OH-5	Outer Harbor, located on west face of reef off Anasosopo Point, Transects at 25, 40, and 60 feet	1466 (S) <i>{1646 (S)}</i>	1799 (S) <i>{1992(S)}</i>
<p>(a) The shore-based Mini-Ranger transponders were located at survey control points as follows:  Code 1 - located at Pago Pago Harbor Front Range Tower (261,551.58E and 309,857.04N, State Coordinates (feet));  Code 4 - located at Fagatogo Tram Park Building (258,117.06E and 305,879.24N, State Coordinates (feet)).</p> <p>(b) The navigation readings are designated as either north (N) or south (S) of the alignment between the Code 1 and Code 4 shore transponder stations.</p>			

Each of the four sites was relocated in 2002 by means of the transect marker stakes placed in 1993 (or as replaced in 1995 or 1997) at the start of each transect. Transect marker stakes were relocated by visual positioning and GPS positioning. Markers at some of the transects were degraded or missing and were replaced. However, sufficient markers were recovered at all locations to provide a high degree of confidence that the same transects were filmed as in the previous surveys. A buoy was deployed to assist divers to search for the stakes when not immediately recovered.

### **2.3 Reef Transect Methods**

Marine biologist-divers recorded underwater video transects on the reef front at the four sites in Pago Pago Harbor (Figure 1-2). Video transects were recorded along the reef face at three depths. Each video transect was conducted parallel with the reef face (along a constant depth contour) along a 30-meter fixed transect line on the reef. The depths at which video transects were recorded included: the reef edge (15- to 20-foot depth), on the reef face (at 30- to 40-foot depth), and near the base of the reef face (at 55- to 65-foot depth).

One diver maintained position along the transect stake location and handled a 100-foot tape measure (also marked in meters). The other diver swam slowly along the established 30-meter transect line with the video camera. At the completion of the transect filming, the transect line was picked up and moved to the next transect depth and the procedure was repeated.

A field logbook was maintained and included: the sampling dates and times, descriptions of the site, transect depths, reef face structure and features, reef biota observations, and weather and sea conditions. The videotape was reviewed at the completion of each day in the field to ensure that the record is complete and to verify the location of each transect record on the video tape.

## ***2.4 Quality Assurance and Quality Control***

The quality assurance and quality control objectives for the coral reef surveys are to record representative reef-front transects at each site and provide scientific interpretations and summaries of these reef transect videos that are of known and acceptable quality. The following requirements were instituted for the field data collection to meet the objectives.

- Establish long-term transect markers and document survey site positions (within 2 meters) for repeat surveys.
- Provide field equipment redundancy (backup equipment).
- Develop a field operations and safety plan for conducting the reef surveys to summarize the schedule, survey procedures, field data recording, and safety procedures. This operations and safety plan is a key element of quality assurance and control activities.
- Test all dive and photographic equipment onsite prior to the beginning of the surveys and conduct daily equipment checks.

In addition, the data analysis, described below in Section 3, was accomplished in a manner to provide verifiable photographic interpretations of the reef transect videos. Portions of video transects were reanalyzed to verify transcription accuracy.



### **3. DATA ANALYSIS AND PRESENTATION OF RESULTS**

The field surveys of the fringing coral reef in Pago Pago Harbor were conducted March 13-14, 2002. The coral reef surveys are used to evaluate the condition of, and changes to, the reef-face habitat in Pago Pago Harbor in the vicinity of the JCO. The surveys are limited to providing semi-quantitative data on the type and percent cover of live reef corals and other benthic species. The intent of the surveys is to provide information necessary to generally characterize and document changes to the reef habitat. It is not intended that the data be used to quantitatively describe details of the reef habitat or communities. The surveys are targeted at examination of the benthic substrate and species. Reef fish identifications are not an objective of the study.

#### ***3.1 Analysis of Video Tapes***

The videotape transect records were analyzed and summarized by a qualified marine ecologist with tropical reef knowledge and several years of experience specifically in American Samoa. The videotape analysis involves repeated slow-frame viewing of the transect video to record estimates of live coral coverage and specific benthic genera. The percent of live coral was estimated at 5 meter intervals along the transect line, for 2.5 meter segments. Benthic genera identifications were made, as feasible, from the video record. Field survey data was then summarized from notes made during the video transect viewing.

Using mobile species like fish to assess ecological impacts or habitat quality on a relatively small scale is not feasible without conducting the survey over a long period of time. Many environmental and behavioral factors (season, lunar phase, time of day, tide, weather patterns, etc.) may influence the abundance of fish species in a given area at a given time. Using the sessile benthic community (primarily scleractinian corals) and habitat complexity and structure to assess the prevailing or average ecological condition introduces the least amount of bias due to immediate conditions and diver avoidance.

Data collection with video tapes of prescribed areas, or transects, reduces the limitation of SCUBA diver bottom time. However, some detail will be lost and some bias will be introduced by the camera and the camera operator. Use of video transects in this case reduced the ability to detect and distinguish between encrusting corals, coralline algae, sponges and other organisms. Camera operator bias can be introduced in several ways; traveling speed and distance from bottom, camera angle, straying from transect, recognition of organisms requiring closer focus to be identified by the video tape reviewer, and in some cases, not providing scale with the transect line as a reference.

Translation of the video tape records into semi-quantitative data required identifications, and estimations of sizes and percentage of area covered, to the extent possible by viewing the tapes. Coral identification is only provided to the generic level. Levels of uncertainty vary and depend on colony size and shape and the uniqueness of the colony form to certain

genera (for example *Echinopora* and *Montipora* are easily confused by video inspection). Distance, angle and form of the colony can cause errors in estimating size and areal coverage. This is compounded by the inability to distinguish between encrusting organisms.

Although there are biases unavoidably introduced in a survey such as the one reported here, gross identification of the larger benthic organisms, including corals, and a general characterization of the habitat structure and complexity were achieved. Biological interpretations and projections of the results are difficult, and are especially vulnerable to an individual's predicated bias. However, for the purpose of detecting general habitat changes over long time periods the techniques used in this survey are acceptable and adequate to achieve the objectives of the NPDES permit condition.

### **3.2 Reef Survey Results**

The transect analyses notes are presented in Appendix A. Table 3-1 summarizes the semi-quantitative survey results. The summary table provides the station characteristics, benthic or sessile organisms coverage, and hard coral coverage for each transect. Copies of the video records are provided to ASEPA and USEPA as a separate attachment to this report.

Stations MH-1 is located along the northern shore that receives direct wave impacts from the south. The transects conducted at this station had 78 percent live coral coverage at the 25-foot transect depth, compared to 36 percent in the 1997 survey. The 40-foot depth had coverage of hard coral of 50 percent compared to 22 percent in 1997. The lowest coverage at this station was 32 percent at the 60-foot depth compared to 8 percent in 1997. Coverage in previous surveys (1995, 1993, and 1991) was even lower than the 1997 survey percent cover values. The severe impacts of Tropical Cyclone Val in December 1991, Tropical Cyclone Ofa, in February of 1990, and Tropical Cyclone Lin in February of 1993 were evident in previous surveys. For example, in the 1993 survey the 25- and 40-foot transects at this station showed much higher sand/silts and rubble coverage, which represented a substantial increase over the 1991 values. Evidence of the hurricane wave forces is exhibited by the six longline vessels that were grounded on the reef flats between Leloaloa and the harbor navigation range marker (site of MH-1).

The results of the reef survey at MH-4, located inside the semi-enclosed embayment between Leasi Point and Aua Point, show moderately diverse coral representation. The 25-foot transect at these stations had 35 percent live coral compared to 28 percent live coral in the 1997 survey and 20 percent in the 1993 survey. In this survey (March 2002) the coverage of the bottom with sand/silt and rubble at MH-4 remained essentially the same as in the 1997 survey.

The percentages of live corals on the steep reef face structure at Station OH-1 increased noticeably at the 25- and 40- foot depths compared to 1997. The 1997 survey showed similar conditions to the 1993 and 1995 surveys. Silt coverage, and benthic diversity observed at Station OH-1 was comparable to the reef face conditions during 1997. Wave conditions are more intense at this station than the others surveyed.

Table 3-1												
Results of March 2002 Coral Reef Survey												
Station	MH-1			MH-4			OH-1			OH-5		
Station Characteristics												
Depth (ft)	25	40	60	25	40	60	25	40	60	25	40	60
Percent Sand, Sediment & Rubble		5	15	20	60	85	3	7	80	1	5	40
Refuse				<1	<1	<1						
Slope Description	FS	T/S	T/G	T/S	T/S	G	W	W	FS	W	FS	G
Sessile Organisms (percent coverage)												
Algae		<1	3	1	1			<1		<1	4	1
Coralline algae	10	35	45	20		2	45	55	10	50	50	40
Encrusting ascidians							5P	2P	2P	2P	2P	1P
Encrusting sponges	5P	5P	2P	2P	1P		3P	3P	2P	2P	5P	5P
Sponges	5	5	2	8	3	2	7	7	1	3	5	3
Unidentified epiphytes					<1	<1		1	3			5
Styllaster (hydrocorallina)								<1				
Millepora (hydrocorallina)					<1					3		
Zoanthids	3			4	<1							
Soft coral			2	10	4							
Other Organisms							3P					
Hard Coral (percent coverage)												
Pocillopora	10	3								5		
Montipora	50	35	22	8	1		25	20		20	25	4
Acropora	2	5								3		
Fungia		1	<1		<1	<1				1	1	
Porites	5	5	3	15			2P	3	2	6	3	1P
Faviidae	<1						5	1		3	<1	
Diploastrea heliopora	5		3	12	25	10			<1			
Galaxea		<1						<1		<1	<1	
Lobophyllia			1									
Styllophora										<1		
Astreopora							2					
Turbinaria (or Mycedium)			2									
Unidentified Encrusting Forms	5				3							
Total Percent Live Hard Coral	78	50	32	35	30	11	34	25	3	40	31	5
Total Number of Hard Coral Genera	6	6	6	3	3	2	4	4	2	5	5	2
Total Hard Coral Genera per Station	10			4			6			8		
P = believed to be present (coverage estimated)												
<1% = 1% when calculating coverage												
Unidentified not included in genera count												
Coverage does not include Styllaster and Millepora												
Slopes as follows: G = Gradual, FS = Fairly Steep, S = Steep, W = Wall, T = Terraced												

The transect conducted at 25- and 40-feet at Station OH-5 consists primarily of a steep slope of staghorn coral (*Acropora*) rubble with coralline algae and encrusting sponges and ascidians on the rubble. OH-5 had a similar species composition in previous surveys. The total percent live hard coral at OH-5 was greater in 2002 than in 1997 at all depths. Visual observations in 1991 and 1993 showed that this reef face displayed indications of typical wave damage down to 50 feet depth. The sand/silt and rubble coverage at these two transect depths was much improved in 1997 from previous surveys, and improved even further at the 60 foot depth in 2002. Station OH-5 is located approximately 600 feet from the JCO diffuser. No evidence of the wastewater impacts or settleable solids was observed at this station.

### **3.3 Discussion of Results**

This report presents the results of the coral reef survey conducted to monitor possible changes in reef conditions following relocation of the canneries discharge points and the implementation of high strength waste segregation. These coral reef field surveys were also designed and conducted to allow comparisons of the reef conditions over time. Previous coral reef survey reports also provided comparisons between regions in the harbor.

A general qualitative comparison can be made between this survey and the previous surveys done by CH2M HILL in 1991, 1993, 1995 and 1997. The results of this comparison are summarized in Table 3-2. Table 3-2 attempts to provide an overall synthesis by examination of the total percent covered by hard coral at all depths combined, and the total number of genera identified. The summary of results includes the following points:

- Three of the four stations show apparent improvement over time in terms of percent hard coral coverage.
- Station MH-1 also appears to show a trend towards higher diversity in terms of total number of genera.
- Station MH-4 does not indicate as clear a trend of improvement, but there is no indication of degradation. This station appears to be affected by sediment loads from the nearby stream, and this is reflected in the observation that the percent sand and silt is substantially higher than for the other stations.
- Station OH-5, closest to the JCO discharge appears to be improving, and no effect of the discharge is discernable.

Table 3-3 provides a more detailed comparison than discussed above for total percent live hard coral and the total number of hard coral genera for all the studies by transect and depth. Differences in details such as variability with depth of actual numbers and genera, and other station characteristics, can be examined by comparing Table 3-1 with previous results in the reports for the 1997, 1995, 1993, and 1991 surveys.

**Table 3-2**  
**Summary Results of the 2002, 1997, 1995, 1993 and 1991 Coral Reef Surveys**  
**For 2002 Transects**

Station	MH1	MH4	OH1	OH5 <sup>A</sup>
March 2002 Survey				
Total Percent Live Hard Coral Coverage (depth average)	52	25	21	36
Total Number of Live Hard Coral Genera Identified per Station (all depths)	11	5	6	8
March 1997 Survey				
Total Percent Live Hard Coral Coverage (depth average)	22	22	15	18
Total Number of Live Hard Coral Genera Identified per Station (all depths)	9	6	6	5
March 1995 Survey				
Total Percent Live Hard Coral Coverage (depth average)	9	33	20	21
Total Number of Live Hard Coral Genera Identified per Station (all depths)	5	8	5	6
February 1993 Survey				
Total Percent Live Hard Coral Coverage (depth average)	11	15	13	6
Total Number of Live Hard Coral Genera Identified per Station (all depths)	5	4	6	4
January 1991 Survey				
Total Percent Live Hard Coral Coverage (depth average)	13	20	8	8
Total Number of Live Hard Coral Genera Identified per Station (all depths)	4	7	4	7
<sup>A</sup> The 60 foot depth data removed from OH-5 to make results comparable with the 1991 survey.				

**Table 3-3**  
**Summary Results of the Coral Reef Survey Transects**  
**by Depth for Stations Occupied in 2002**

Station	MH1			MH4			OH1			OH5		
Depth (ft) for all Surveys Except 1991	25	40	60	25	40	60	25	40	60	25	40	60
<b>March 2002 Survey</b>												
Total Percent Live Hard Coral	78	50	32	35	30	11	34	25	3	40	31	5
Total Number of Hard Coral Genera	6	6	6	3	3	2	4	4	2	5	5	2
<b>March 1997 Survey</b>												
Total Percent Live Hard Coral	35	22	8	28	31	7	24	16	4	21	15	1
Total Number of Hard Coral Genera	6	5	5	5	2	2	4	3	2	5	3	0
<b>March 1995 Survey</b>												
Total Percent Live Hard Coral	7	15	5	25	26	3	34	25	0	29	12	1
Total Number of Hard Coral Genera	3	3	4	3	2	2	4	3	0	6	2	0
<b>February 1993 Survey</b>												
Total Percent Live Hard Coral	20	<9	<5	20	30	0	27	7	<5	5	7	4
Total Number of Hard Coral Genera	2	4	0	1	1	0	5	2	0	2	4	2
<b>January 1991 Survey</b>												
Total Percent Live Hard Coral	<1	>30	>8	10	50	0	10	<5	<10	10	5	--
Total Number of Hard Coral Genera	1	3	3	1	1	0	3	2	3	4	4	--
Depth (ft) for January 1991 Study	20	35	55	15	40	60	20	35	60	30	50	--



## 4. REFERENCES

### **Coral Reef Surveys:**

CH2M HILL. Use Attainability and Site-Specific Criteria Analyses, Pago Pago Harbor, American Samoa. March 15, 1991.

CH2M HILL. Joint Cannery Outfall Coral Reef Survey Report February 1993 Survey. August 1993.

CH2M HILL. Joint Cannery Outfall Coral Reef Survey Report March 1995 Survey. April 1996.

CH2M HILL and **gdc**. Joint Cannery Outfall Coral Reef Survey Report March 1997 Survey. September 1997a.

### **Water Quality Monitoring:**

CH2M HILL and Glatzel & Associates. Technical Memorandum, Results of March 1995 Harbor Water Quality Monitoring Pago Pago Harbor, American Samoa. 7 July 1995.

CH2M HILL and **gdc**. Receiving Water Quality Monitoring Report, Pago Pago Harbor, American Samoa, March 1996 Sampling. 6 March 1997b.

CH2M HILL and **gdc**. Receiving Water Quality Monitoring Report, Pago Pago Harbor, American Samoa, November 1996 Sampling. 7 March 1997c.

CH2M HILL and **gdc**. Receiving Water Quality Monitoring Report, Pago Pago Harbor, American Samoa, March 1997 Sampling. 1 August 1997d.

CH2M HILL. Receiving Water Quality Monitoring Report, Pago Pago Harbor, American Samoa, March 2001. 19 July 2002a.

CH2M HILL. Receiving Water Quality Monitoring Report, Pago Pago Harbor, American Samoa, October 2001. 5 August 2002b.

CH2M HILL. Receiving Water Quality Monitoring Report, Pago Pago Harbor, American Samoa, March 2002. March 2003a (in preparation).

CH2M HILL. Receiving Water Quality Monitoring Report, Pago Pago Harbor, American Samoa, August 2002. March 2003b (in preparation).

## **APPENDIX A**

### **CORAL REEF TRANSECT ANALYSIS**

**FIELD SURVEYS CONDUCTED 13-14 MARCH 2002**

## TRANSECT SUMMARIES

### FIELD SURVEYS CONDUCTED BY CH2M HILL 13-14 MARCH 2002

#### VIDEO INTERPRETATION BY TROY BUCKLEY

Descriptions of each transect include estimates of the percent areal coverage, summarized over the entire transect, by substrate type and by distinguishable types of biota.

#### **Station MH-1 Transects**

At this station the reef front is fairly steep with a "spur-and-groove"-like topography providing complex and varied habitat. Large coral colonies of *Diploastrea heliophora* and *Porites* were seen near the transects. A large number and variety of fishes were identified at the station that were not encountered on the transects including parrotfishes (scaridae - *Scarus* sp.), wrasses (labridae - *Bodianus axillaris*, *Labroides* sp.), surgeonfishes (acanthuridae - *Acanthurus* sp., *Ctenochaetus striatus*, *Naso lituratus*, *Zebrasoma scopas*), triggerfishes (balistidae), damselfishes (pomacentridae - black and white *Chromis* sp.), bannerfishes (chaetodontidae - *Heniochus monoceros*, *H. varius*, *H. acuminatus*), and butterflyfishes (also chaetodontidae - *Chaetodon unimaculatus*, *C. vagabundus*, *C. ornatissimus*, *C. lunula*, *C. ephippium*)

#### **25-foot Depth**

At a depth of 25 feet, the habitat was composed of a variety of complex coral formations affording a wide size-range of caves, crevices and holes. The substrate was encrusted with coralline algae (10%) and probably sponges (5%). Standing sponges were very common (5%). Living corals were represented primarily by encrusting and plate colonies of *Montipora* (50%), *Porites* (5%), and unidentified types (5%). Small colonies of *Pocillopora* (10%) were numerous, colonies of digitate *Acropora* (2%) were present, and a colony of *Diploastrea heliophora* (5%) and an unidentified Faviid (<1%) occurred. Some zoanthids (3%) were also present and two ropes run through this transect. Wrasses (labridae including *Cheilinus* sp.), damselfish (pomacentridae) including blue damselfish (perhaps *Chrysiptera taupou* [cyanea] or *Pomacentrus pavo*) and farmerfish (*Stegastes* sp.), and a pufferfish (tetraodontidae) were seen on the transect.

#### **40-foot Depth**

At a depth of 40 feet, the habitat was moderately complex, alternating between large limestone boulders, vertical areas with terraced plates and low pockets of rubble. Larger rubble was partially consolidated by encrusting organisms and some horizontal surfaces had some sand and silt (5%). Most hard surfaces were encrusted by coralline algae (35%) and probably some encrusting sponges (5%). Standing sponges (5%) were also common at this depth. Living corals included encrusting and plate-like corals -

*Montipora* (35%) and *Porites* (5%) - digitate *Acropora* (5%), *Pocillopora* (3%), *Galaxea* (<1%), and *Fungia* (1%). A branching, possibly calcified algae (or bryozoan?) (<1%) was also present, and two ropes, partially encrusted by coral colonies, run through this transect. Fishes observed on the transect include butterflyfishes (chaetodontidae - *Forcipiger flavissimus* and *Chaetodon reticulatus*) and farmerfish (pomacentridae - *Stegastes* sp.).

### 60-foot Depth

At a depth of about 60 feet, the habitat alternated between dead coral plates that formed a fairly complex terraced slope, semi-consolidated coral rubble (40 to 60 cm plate and massive forms) and gentler sloping areas with smaller coral rubble. Silt cover (15%) was light on solid surfaces but more concentrated in depressions, often with smaller rubble. Coralline algae (45%) consolidated some of the coral rubble and was common on solid surfaces. Sponges (2%) were seen, but not as numerous as in shallower depths, and encrusting sponges (2%) were probably present. Soft coral (alcyonacea) (2%) was seen. Scleractinian corals were mostly encrusting and laminar plate forms of *Montipora* (22%) and *Porites* (3%). Although a young colony of *Diploastrea heliophora* (3%), a *Fungia* (<1%), a plate-like colony (possibly *Turbinaria* or *Mycedium*) (2%), and a small colony of (probably) *Lobophyllia* (1%) occurred. A fleshy or calcified-looking algae (2%) and a stringy-looking red algae (maybe *Plocamium* sp.) (<1%) occurred. A surgeonfish (acanthuridae) was seen on the transect.

## STATION MH-4 TRANSECTS

At this station, just a few meters from the transect stakes, huge *Diploastrea heliophora* shields extend from the reeftop downwards on the steep reef face. Some digitate *Acropora* and soft corals were seen in the area. Fishes were abundant in this area and include butterflyfishes (*Chaetodon* spp. - chaetodontidae), lemon peel angelfish (pomacanthidae - *Centropyge flavissimus*), and damselfishes (pomacentridae - light blue *Chromis* sp.).

### 25-foot Depth

At a depth of 25 feet, consolidated coral rubble and coral formations were interspersed with depressions where silt and sand (10%) accumulated. Silt (10%) covered some of the consolidated coral formations, especially in pockets of rubble, and a beverage can (<1%) occurred. Sponges (the common, standing, orange type (6%) and a spherical, brown type (2%)) were plentiful. Two types of soft corals (alcyonacea) (10%) were common and zoanthids (4%) were seen. Coralline algae (20%) and probably sponges (2%) encrusted most the coral-free, hard surfaces. Some algae (1%) also occurred. Live coral cover included encrusting and plate forms of *Porites* (rus?) (15%) and *Montipora* (8%), and a few small and large colonies of *Diploastrea heliophora* (12%). The reticulated butterflyfish (chaetodontidae - *Chaetodon reticulatus*), Moorish idol, (zanclidae - *Zanclus cornutus*), surgeonfishes (acanthuridae), and several types of damselfishes (pomacentridae) were seen, including farmerfish (*Stegastes* sp.) and blue damselfish (perhaps *Chrysiptera taupou* [cyanea] or *Pomacentrus pavo*). A starfish was observed near the beginning of the transect.

### 40-foot Depth

At a depth of 40 feet, the silt, sand and rubble slope was periodically interrupted by patches of shields and ledges, consolidated rubble, and consolidated larger coral forms. Overall, silt and sand (60%) covered rubble and solid surfaces, and some of the silt appeared consolidated by epiphytes (<1%) (perhaps hydroids and algae). A palm frond (<1%) and two types of sponges (3%) were seen, and encrusting sponges (1%) were probably present. Soft corals (alcyonacea) (4%), zoanthids (<1%), a fleshy algae (1%) and non-scleractinian *Millepora* (hydrocorallina) (<1%) were present. Scleractinian corals were dominated by remnants of large *Diploastrea heliopora* (25%) shields, but *Fungia* (<1%) and encrusting and thin plate-like corals (*Montipora* - 1% and unidentified - 3%) also occurred. Damselfishes (pomacentridae - including *Stegastes* sp.), pufferfish (tetraodontidae), bicolor angelfish (pomacanthidae - *Centropyge bicolor*), and vagabond butterflyfish (chaetodontidae - *Chaetodon vagabundus*) were seen on the transect.

### 60-foot Depth

At a depth of 60 feet, the water appeared turbid and the visibility was poor. Patches of accumulated silt (40%) interrupted the low-plate and shield formations at the base of the reef slope. One beverage bottle (<1%) was observed. The silt on the low, semi-foliaceous plates and dead coral shields (45%) appeared to be somewhat consolidated by various epiphytes (<1%). Sponges (2%) and coralline algae (2%) were present. Living coral included several young or recovered *Diploastrea heliopora* (10%) colonies and a *Fungia* (<1%). Damselfishes (pomacentridae) and wrasses (labridae) were seen on the transect.

### Station OH-1 Transects

At this station, the reef face is nearly a vertical wall with overhangs and caves providing some complexity. The wall extends down to a depth of about 60 feet where the transition to a silt, sand and rubble slope takes place. A large *Diploastrea heliopora* colony was seen below the 25-ft depth transect stake. Near the 40-ft depth transect stake, colonies of *D. heliopora*, *Porites rus* and *Montipora* plates were seen. The non-scleractinian "pink lace coral" *Stylaster* (hydrocorallina) occurred under ledges. The wide variety of fishes in the area were also mostly seen on the transects, except for a large group of poison-fang blennies (blenniidae - *Meiacanthus atrodorsalis*).

### 25-foot Depth

At a depth of 25 feet, the nearly vertical reef face had a wide size-range of holes, caves and overhangs that gave the habitat some complexity. A little sand and silt (3%) occurred on horizontal surfaces. The hard substrate was encrusted with coralline algae (45%), probably encrusting sponges (3%), ascidians (5%) and other organisms (3%). Sponges were very common (7%). Living corals were represented primarily by encrusting and plate colonies of *Montipora* (25%), encrusting to massive Faviids (and/or Mussids) (5%), *Astreopora* (2%) and probably *Porites* (2%). Many fishes were seen on and near the transect at this depth including damselfishes (pomacentridae) of the genera *Abudefduf*, *Chromis*, *Stegastes*, and either *Chrysiptera taupou* [cyanea] or *Pomacentrus pavo*; Moorish idols (zanclidae - *Zanclus cornutus*); goatfish (mullidae); wrasses (labridae);

pufferfish (tetraodontidae); and surgeonfishes (acanthuridae - *Acanthurus* sp., *Ctenochaetus striatus*, *Zebrasoma scopas*).

#### 40-foot Depth

At a depth of 40 feet, the reef face was steeply sloping or nearly vertical with many overhanging ledges and caves that created some complexity at a variety of scales. Silt (7%) accumulated with some rubble in one low pocket and covered some of the horizontal surfaces where it seemed somewhat consolidated by epiphytes (possibly algae and hydroids) (1%). Filamentous algae was seen (<1%) and most surfaces were encrusted by coralline algae (55%), sponges (maybe 3%) and possibly ascidians (maybe 2%). Sponges (7%) were also numerous at this depth. The non-scleractinian "pink lace coral" *Stylaster* (hydrocorallina) (<1%) was seen under a ledge. Encrusting and plate-like corals - *Montipora* (20%) and *Porites* (3%) - were the most common types, but small massive colonies of an unidentified Faviid (1%) (possibly *Montastrea*) and *Galaxea* (<1%) also occurred. Damselfishes (pomacentridae), surgeonfishes (acanthuridae) and a small white fish, probably a gobi (gobiidae), were seen on the transect.

#### 60-foot Depth

The transect at a depth of 60 feet was mostly on a rubble and silt slope at the base of the reef wall. It crossed a variety of low complexity habitat types, from a sand and silt bottom with dead *Diploastrea heliophora* shields overhanging above, to a near vertical reef wall to low consolidated coral formations. Overall, silt and sand (70%) bottom, sometimes mixed with rubble, and silt on solid horizontal surfaces of coral formations (10%) were most common. Epiphytes (3%) may have been consolidating some of the silt. Few sponges were seen (1%), and most silt-free surfaces were encrusted with coralline algae (10%) and probably encrusting sponges (2%) and ascidians (2%). Few living coral colonies were encountered - encrusting *Porites* (2%) and *Diploastrea heliophora* (<1%). Many fishes were observed on the transect including farmerfish (pomacentridae - *Stegastes* sp.), jewel damsels (pomacentridae - *Plectroglyphidodon lacrymatus*), regal angelfish (pomacanthidae - *Pygoplites diacanthus*), Moorish idols (zanclidae - *Zanclus cornutus*), parrotfish (scaridae), filefish (monacanthidae), goatfish (mullidae), and a honeycomb grouper (serranidae - *Epinephelus* sp.).

#### Station OH-5 Transects

At this station the "spur-and-groove"-like reef face slopes away from the reef break, decreasing in steepness with increasing depth. Habitat complexity, coral diversity and fish abundance appear to be fairly high. Fishes observed at this station, but not on the transects include wrasses (labridae - *Labroides dimidiatus*, *Cheilinus* spp.), parrotfishes (scaridae), damselfishes (pomacentridae - *Pomacentrus vaiuli*), butterflyfishes (chaetodontidae - *Chaetodon ephippium*, *C. trifasciatus*, *C. unimaculatus*), surgeonfishes (acanthuridae - *Naso lituratus*, *Acanthurus nigricans*, *A. thompsoni*), and jacks (carangidae - probably *Caranx sexfasciatus*).



## 25-Foot Depth

At a depth of 25 feet, the transect crossed a spur and groove reef front below the reef break. The habitat was a complex array of large and small formations and crevices creating a fairly rugose habitat. Silt (1%) rarely occurred and only in small pockets with rubble. Some of the *Fungia* appeared to be partially white indicating recent stress due to high water temperatures or siltation, or perhaps natural death. Most of the larger coral rubble and formations were solidly consolidated by coralline algae (50%), encrusting sponges (maybe 2%) and ascidians (maybe 2%). Sponges (3%) and stringy-looking red algae (maybe *Plocamium* sp.) (<1%) were observed on the transect. Most living corals were large and small encrusting colonies of *Montipora* (20%), *Porites* (5%), *Acropora* (3%), and non-scleractinian *Millepora* (hydrocorallina) (3%). Other small colonies were common and include *Pocillopora* (5%), unidentified faviids (3%), *Porites rus* (1%), *Fungia* (1%), *Styllophora* (<1%) and *Galaxea* (<1%). were also identified. Surgeonfishes (acanthuridae - *Acanthurus* sp., *Zebrasoma scopas*, *Ctenochaetus striatus*); Moorish idol (zanclidae - *Zanclus cornutus*); regal angelfish (pomacanthidae - *Pygoplites diacanthus*); reticulated butterflyfish (chaetodontidae - *Chaetodon reticulatus*); damselfishes (pomacentridae); including many blue damsels (*Chrysiptera taupou* [cyanea] or *Pomacentrus pavo*), white-tail damsels (*Chromis* sp.), jewel damsels (*Plectroglyphidodon lacrymatus*), Johnston Island damsel (*P. johnstonianus*), and scissor-tail sergeants (*Abudefduf sexfasciatus*); and trumpetfish (aulostomidae - *Aulostomus chinensis*) were seen on this transect.

## 40-Foot Depth

The transect at the 40 foot depth is still in spur and groove topography, and is fairly complex habitat with a variety of holes and crevices. Very little silt (5%) was present except for some accumulations in the lowest areas, sometimes with small rubble. One rope crossed the transect at this depth. Solid surfaces were encrusted and loose rubble was semi-consolidated by coralline algae (50%), encrusting sponges (maybe 5%) and ascidians (maybe 2%). Standing sponges (5%) were common, and patches of fleshy, stringy-looking red algae (maybe *Plocamium* sp.) (1%) and a whitish fleshy algae (3%) were also noted. The live coral cover was mostly dominated by encrusting or small, plate-like forms of *Montipora* (25%) and *Porites* (3%), but a small colony of *Galaxea* (<1%), an unidentified Faviid (<1%), and several small *Fungia* (1%) were also seen. A high diversity and number of fishes were also seen on the transect at this depth, including angelfishes (pomacanthidae - *Pygoplites diacanthus*, *Centropyge flavissimus*); butterflyfishes and bannerfishes (chaetodontidae - *Chaetodon reticulatus*, *Heniochus* sp.); juvenile and adult parrotfishes (scaridae); Moorish idol (zanclidae - *Zanclus cornutus*); surgeonfishes (acanthuridae); filefish (monacanthidae); pufferfish (tetraodontidae); poison-fang blennie (blenniidae - *Meiacanthus atrodorsalis*); flame-tailed snapper (lutjanidae - *Lutjanus fulvus*); bigeye emperor (lethrinidae - *Monotaxis grandoculus*); and damselfishes (pomacentridae - including blue damsels (*Chrysiptera taupou* [cyanea] or *Pomacentrus pavo*, and farmerfish (*Stegastes* sp.)).

## 60-Foot Depth

At a depth of 60 feet, the gentle slope habitat was composed of semi-consolidated rubble of various sizes and low coral formations. Loose sand and silt (40%) was accumulated in

depressions but was on some hard surfaces and occasionally appeared consolidated by epiphytes (5%). Coralline algae (maybe 40%) encrusted most of the silt free hard surfaces, but encrusting sponges (5%) and ascidians (1%) may have also been present. Sponges (3%) were fairly common and a few patches of fleshy, stringy-looking red algae (maybe *Plocamium* sp.) (1%) also occurred. There appeared to be very little live coral cover at this depth, and it consisted of some small, thin, plate-like or encrusting colonies of *Montipora* (4%) and perhaps *Porites* (1%). A dead *Fungia* was seen. A similar community of fishes were observed here as in shallower depths at this station and included farmerfish (pomacentridae - *Stegastes* sp.), reticulated butterflyfish (chaetodontidae - *Chaetodon reticulatus*), surgeonfishes (acanthuridae), several bicolor angelfish (pomacanthidae - *Centropyge bicolor*), regal angelfish (pomacanthidae - *Pygoplites diacanthus*), and goatfishes (mullidae) were seen mostly near the sand bottom.



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3 March 2002

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Enclosed are two copies each of the following reports required by the NPDES Permits for the COS Samoa Packing and StarKist Samoa Joint Cannery Outfall (JCO) in American Samoa.

- The 2001 Tradewind Season Sediment Monitoring Report: This monitoring was successfully completed. The inner Harbor sediments near the old Cannery outfalls show a qualitative trend toward improvement. The outer Harbor Sediments near the new JCO show no apparent degradation. The report includes tabulations of previous monitoring results for comparison. The results of the extra (one-time) stations and analyses required under the Fish Tissue Study are also included in this report.
- The 2002 Non-tradewind Season Coral Reef Survey Report: The survey at the required transects was completed without problems. The four stations near the JCO are showing an overall improvement over time, and no degradation resulting from discharge through the JCO is apparent in the survey data. Station MH-4 shows no or little improvement, but no degradation. Observations in the field attribute this difference compared to other stations to sediment loads from the stream flow entering the Harbor at Aua.

Please call us if you have any questions or comments on the enclosed report,

Sincerely,

Karen A. Glatzel

Steven L. Costa

Cc: Jim Cox, COS International; Herman Gebauer, COS; Brett Ranisby, COS;  
Steve Erickson, Del Monte Foods; Phil Thirkel, StarKist Samoa; Joe Carney, StarKist Samoa;  
David Wilson, CH2M HILL.